ALBERTA HERITAGE FOUNDATION FOR MEDICAL RESEARCH

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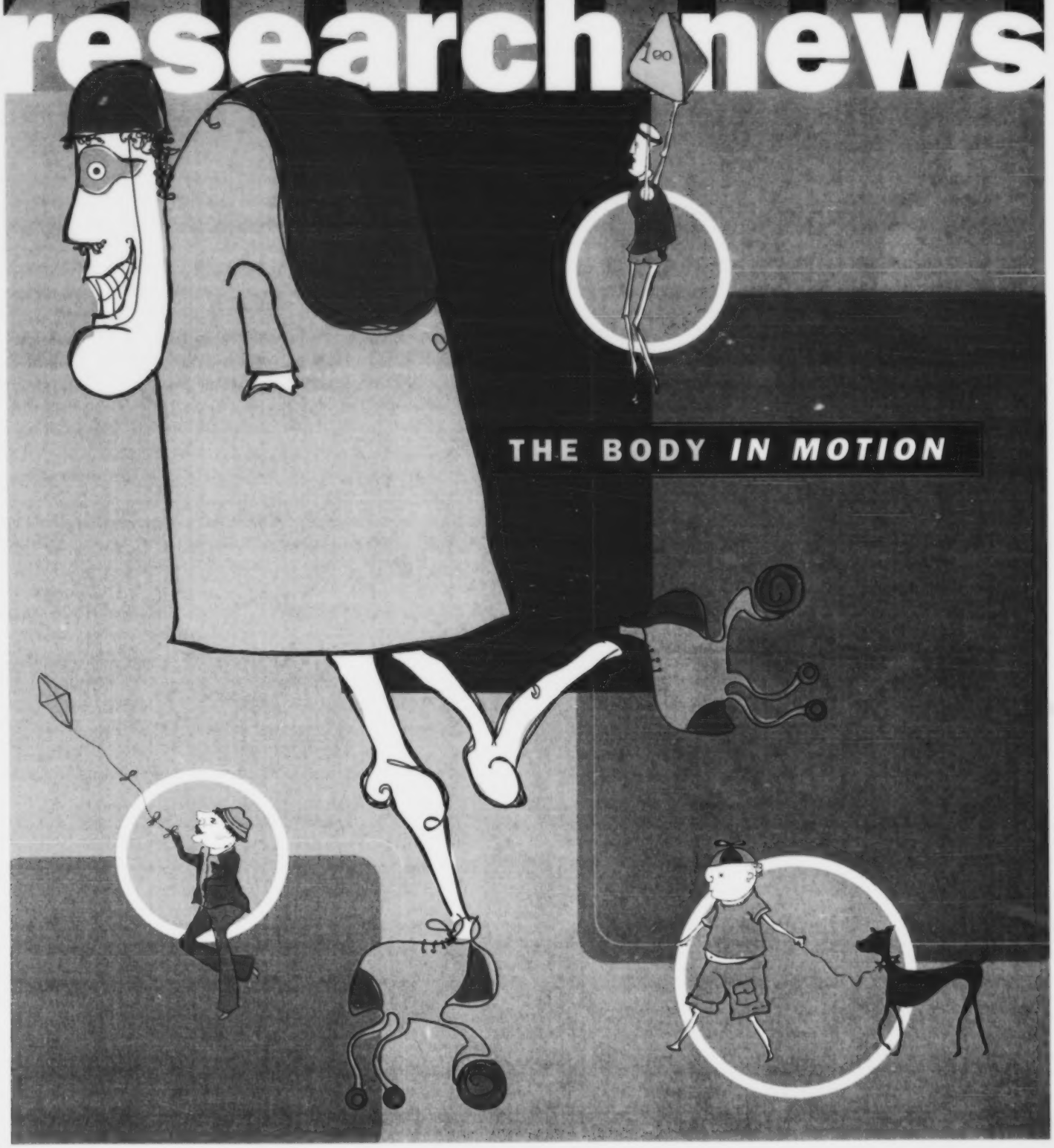
research news

SUMMER 2002



THE BODY *IN MOTION*

research news

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2 **Physical activity and the battle against cancer**

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6 **It's not age, it's illness**

Dr. Allen Dobbs has developed a tool to assess the driving abilities of people with cognitive decline.

10 **On the cutting edge of joint research**

Scientists at the University of Calgary's McCaig Centre for Joint Injury and Arthritis Research are gaining recognition for their revolutionary work in gene therapy, ligament transplantation, and arthritis treatments.

19 **Finding one's balance**

A large mass balanced on spindly sticks is how Dr. John Misiaszek describes human balance—the focus of his research.

Regular features

Research Views featuring Lee and Michael Stones.....1
Researchers in the making.....20
Reader resources.....21
Back page
Heritage Youth Researcher Summer Program.....22

AHFMR Mission

AHFMR supports a community of researchers who generate knowledge that improves the health and quality of life of Albertans and people throughout the world. AHFMR's long-term commitment is to fund basic, patient and health research based on international standards of excellence and carried out by new and established investigators and researchers in training.

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Since that time, the Stoneses have actively pursued their research on sexuality and aging. Authors of the book Sex May Be Wasted on the Young, Lee and Michael often speak to community and seniors groups, and at conferences. They discussed their work and their experiences dealing with these issues at the 5th Biennial Western Canadian Conference on Sexual Health.

The Stoneses point out that comprehensive data on later-life sexuality has only recently become available. "Alfred Kinsey's famous human sexuality reports in the late '40s and early '50s devoted only 7 of the 1400 pages to sexuality in people over the age of 35," Michael points out. A 1999 survey by the American Association of Retired Persons was the first study done on the topic using a representative sample of the population. "Until we published our book in 1996, there was certainly nothing in Canada on this topic."

Recent information has suggested that sexuality in seniors is less related to intercourse and orgasm and more related to kissing, hugging, and touching. This focus on foreplay and arousal can actually enhance intimacy and therefore improve the sexual relationships of seniors. On the downside however, disease, medications, and declining health all affect sexual thoughts to a greater degree as people age—conditions such as high blood pressure, diabetes, and depression are some of the most common factors. Disease and medications seem to affect men more than women in terms of sexuality. But these factors aside, sexual needs do not really change a great deal as people age, Lee says. "We tend to slot people according to age group and we forget that the things that drive you, the things that you need to have a good life, really don't change. You always need love and affection."

The topic of sexuality and aging has seen a recent resurgence of interest, one of the reasons that the Stoneses' book is to be reissued in December 2002. The updated version will include new chapters on the roles of Viagra and the Internet in the sexual relationships of older people. The Stoneses credit some of the rising interest to these two factors, as well as to ongoing media attention spotlighting our aging population. "And the fact that this aging population of ours is made up of the baby boomers," adds Michael. "They're the ones who started the sexual revolution back in the '60s!"

DR. CHRISTINE FRIEDENREICH

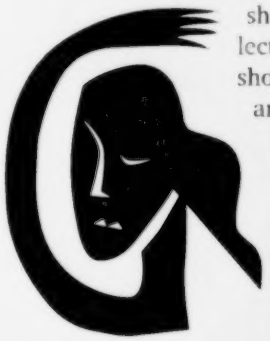
Physical activity and the battle against cancer

"This is great news for women who have not been physically active," says Dr. Friedenreich. "Basically, our study shows that it's never to late to start. Once women start to be physically active, their risk of breast cancer decreases by 40%. For those who have been active throughout their lives, their risk of breast cancer is reduced by 42%."

The three-year study involved 2,478 women who were questioned intensively about physical activities throughout their lifetime. Key to the study was the "Lifetime Total Physical Activity Questionnaire" developed by Dr. Friedenreich and Dr. Kerry Courneya, Professor in the University of Alberta's Faculty of Physical Education and Recreation. The questionnaire measures all types of activity performed throughout a person's lifetime, including occupational, household, and recreational activity.

"It's important that we're talking about physical activity, which is much broader than exercise," notes Dr. Friedenreich. "We found that it is overall lifetime activity, not just exercise, that reduces the risk of breast cancer."

Dr. Friedenreich's team is currently conducting a study on endometrial cancer that will collect blood and tissue samples from participants. "This study is a departure from our work to date, which has focused on epidemiological data," she explains. "It's exciting to be collecting biological data, because it should help us as we attempt to answer the question, why does physical activity reduce cancer risk? We have some ideas involving sex hormones, body fat, insulin, and immune factors, but we do not know which biological mechanisms are responsible for this decreased risk."



Friedenreich and Courneya are involved with another study, beginning this year–a controlled trial of exercise for the rehabilitation of women newly diagnosed with breast cancer. Women from Vancouver, Edmonton, and Ottawa are randomly assigned to two groups: one where participants follow an exercise program, and a control group that does not exercise. "Very few research teams are doing this kind of controlled trial," says Dr. Friedenreich. "We're on the leading edge of this work."

"We know that physical activity is important for the prevention of many chronic diseases, and now it is becoming clear that there is a reduced risk of many cancers among physically active people," she says. "We still need to clarify the exact amount of activity and the time period or periods in life when activity is particularly important to reduce cancer risk."

The research team for these cancer and physical activity studies is made up of scientists from the Alberta Cancer Board, the University of Calgary, and the University of Alberta. Funding has been received from the Canadian Breast Cancer Research Initiative, the Alberta Cancer Board, the National Cancer Institute of Canada, Health Canada, and the Canadian Institutes of Health Research (CIHR). Dr. Christine Friedenreich is a Heritage Health Scholar and a CIHR New Investigator.

Recent publication

Friedenreich CM. Physical activity and cancer prevention: from observational to intervention research. *Cancer Epidemiology Biomarkers and Prevention* 2001 Apr;10(4):287-301.

AHFMR's Community Consultation 2002

AHFMR's Board of Trustees undertook a Community Consultation in January of this year. The purpose was severalfold. First, AHFMR has an ongoing commitment to and record of consulting with its communities through informal and formal mechanisms; the Consultation would continue this approach. Second, the Consultation would provide a good sense of the current challenges, barriers, and environment in the health research field. Finally, the Consultation would provide valuable opinions, advice, and information for future planning by the Trustees.

Calder Bateman Communications was selected through a competitive process to carry out the Consultation for AHFMR. By the time the Consultation wrapped up in June, more than 2000 Albertans had participated through focus groups, personal interviews, mail-in surveys, Web-site surveys, and telephone questionnaires. Respondents included AHFMR researchers, decision-makers in the health regions, university and political leadership, teachers, students, members of the public, and physicians. Many AHFMR Research News readers were also randomly selected to participate in the Consultation.

We are pleased to report that the results of Consultation 2002 show a very positive response to AHFMR's mandate, programs, and services. Most people think AHFMR is doing an outstanding job for Alberta, with the strongest message being "stay the course". However, it is also clear we cannot rest on our laurels. There are still many improvements to be made and directions to be considered–and that's what AHFMR Trustees will be doing in their fall 2002 planning meeting.

On behalf of AHFMR's Trustees and Dr. Matt Spence, our President and CEO, I would like to thank everyone who took the time to participate in our Consultation. We have the results of the Consultation available to anyone who requests them. Please write, phone, e-mail, or fax us (contact information inside the front cover page) to receive a copy of the Consultation results. You may also view the results on our Web site at **www.ahfmr.ab.ca**.

Have a safe and healthy summer.

Kathleen Thurber

Executive Editor
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Building Healthy Lifestyles

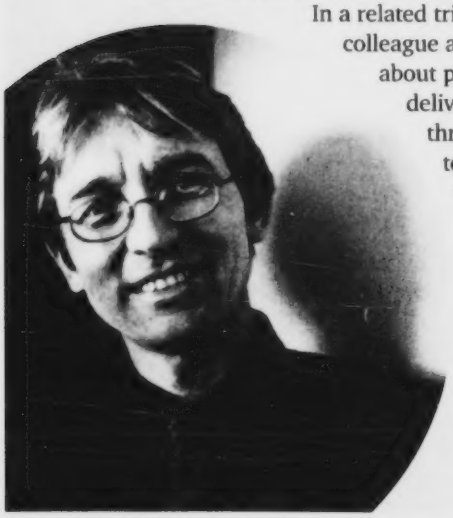
Just Do It! The well-known Nike slogan conjures up images of the super-fit: high-performance athletes, wearing high-performance clothing, who sweat intensely and look good doing it.

It's a message that appeals to people who are already active, rather than the 60% of the population who are not, says Heritage Population Health Investigator Dr. Ron Plotnikoff, an associate professor at the University of Alberta. "It might motivate marathoners to become ultra-marathoners, but most likely it puts off the couch potatoes, who are the ones we really need to target to increase the health of our population," he points out.

Dr. Plotnikoff devotes much of his research time to developing and testing theories, programs, and messages to help that 60% become active and stay active. His materials are specifically aimed at the readiness of a person or group to become physically active.

Dr. Plotnikoff studies primary and secondary prevention of heart disease and diabetes through health lifestyle behaviours–mainly physical activity–at both individual and societal levels. He conducts a wide variety of studies within the context of schools, workplaces, clinical settings, and the general community. One of his current projects involves testing the effectiveness of Canada's Physical Activity Guide and motivational materials that target people's stage of physical-activity readiness at three large work sites–the Northern Alberta Institute of Technology (NAIT), the Capital Health Authority (CHA), and the City of Calgary. He has also been commissioned by Alberta Community Development to develop a program standard and assessment tool for physical activity in the workplace.

In a related trial, Dr. Plotnikoff and a colleague are developing messages about physical activity and diet, delivering the messages through computer-based technology in Alberta workplaces, then testing how effective these messages are in preventing diabetes. In another project, Dr. Plotnikoff is conducting two large population-based, longitudinal studies of the lifestyle habits of adults in Alberta who have type 2 diabetes. He is also working on projects tracking the relationship between diabetes and physical activity in an aboriginal population at the Saddle Lake Reserve and developing effective physical activity programs for First Nations populations. In collaboration with Dr. Gerry Predy, Medical Officer of Health for the CHA, Dr. Plotnikoff is setting up an obesity surveillance system within the Capital Health Region to track children's diet and physical activity. This is a very timely area of interest, given the federal health minister's recent launch of Canada's Physical Activity Guides for Children and Youth.



DR. RON PLOTNIKOFF

"These and my other projects are all related," Dr. Plotnikoff points out. "We're talking about lifestyle behaviours–physical inactivity, high-fat dietary behaviours or obesity, and smoking–and they all link to heart disease and diabetes, which are extremely prevalent in segments of our population. We really have to focus on prevention and start as early as possible, which is where the child obesity study fits into the continuum."

In addition to his many research projects, Dr. Plotnikoff also juggles university appointments. He is the Senior Research Associate at the Alberta Centre for Active Living, and has research labs in the University of Alberta's Faculty of Physical Education and Recreation, as well as across campus at the Centre for Health Promotion Studies, where he directs the Physical Activity and Population Lab. "This is the perfect model for me to do my work," he says.

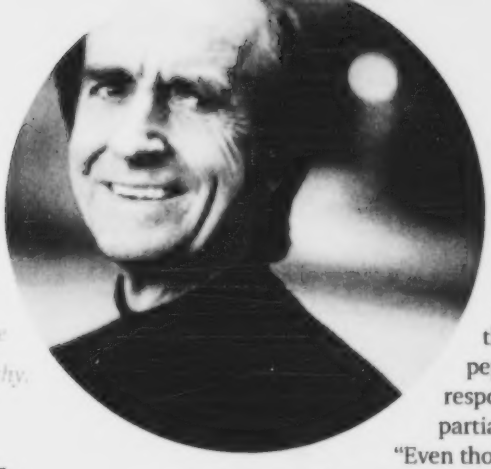
With his varied research interests and his own diverse background–combining an undergraduate degree in physical education, two master's degrees in education, a Ph.D. in behavioural epidemiology (medicine), and post-doctoral work in epidemiology and community medicine–an interdisciplinary workplace is a must for Dr. Plotnikoff.

Dr. Ron Plotnikoff is an Associate Professor at the University of Alberta's Centre for Health Promotion Studies, with a cross-appointment in the Faculty of Physical Education and Recreation. He is an AHFMR Population Health Investigator and holds a Canadian Institutes of Health Research (CIHR) New Investigator Salary Award.

Selected publications

Plotnikoff RC, Hotz SB, Birkett NJ, Courneya KS. Exercise and the transtheoretical model: a longitudinal test of a population sample. *Preventive Medicine* 2001 Nov;33(5):441-52.

Plotnikoff R. Women, heart disease and stroke in Canada: issues and options [brochure]. Ottawa (ON): Heart and Stroke Foundation of Canada; 1997.



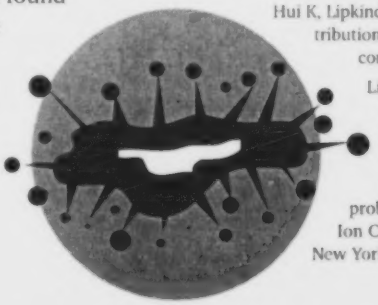
When Dr. Robert French talks about channels, he usually isn't referring to radio or television. Dr. French investigates the molecular structure and function of sodium and potassium ion channels. The biological signals of these cell components keep us alive and healthy.

Unlocking the secrets of ion channels

An ion is an electrically charged atom, such as sodium, circulating in the body. An ion channel is a fairly large protein molecule located within the membrane of the cell, its thin outer envelope. The cell membrane forms a barrier which things like salt can cross only with help from ion channels, says Dr. French, a Heritage Scientist at the University of Calgary.

"Ion channels are little pipes which open to allow particular ions, depending on their size and charge, to flow easily into the cell," he explains. Sodium ions are conducted into the cell by voltage-dependent sodium channels as tiny pulses of current that last about one-thousandth of a second. The sodium channels are crucial for generating nerve impulses, like those which rapidly carry the message from the spine to the muscles that must contract so that you can push off with your foot while running. Other sodium channels trigger the heart's coordinated pumping contractions.

The sodium channel in human nerve cells is a complex molecule consisting of more than 2,000 amino acids, making the channel's structure difficult to study. To explore the structure, Dr. French employs small molecules called peptides; in particular, toxic peptides produced by carnivorous cone snails found throughout the Pacific Ocean. These snails shoot tiny darts out of their venom duct to inject peptides into passing fish. The peptides paralyze the fish by blocking the action of sodium channels in skeletal muscle. Dr. French and his team use the toxic peptides to study the action of individual sodium channels, isolated in the membranes of human nerve cells. They electrically record the current flowing through a single channel as it opens and then closes in response to the peptides. The way the channel responds provides at least a partial picture of its structure. "Even though we do not yet know the complete structure of the sodium channel, using a small toxin with a known structure, we're able to jigsaw together a picture of how specific parts of the channel molecule work in human cells," Dr. French explains.



Membranes of nerve and muscle cells also contain potassium-specific ion channels. These conduct current back into the body's extracellular fluids, to return an "activated" cell to a resting state. Dr. French and his team also investigate a potassium ion channel whose activity is regulated by ATP (adenosine triphosphate). ATP is the molecule that cells use to drive reactions requiring energy. Research indicates that ATP-sensitive potassium channels help protect the heart and the brain from acute ischemia, where blood flow to the tissue is reduced due to a heart attack or stroke.

Many diseases and conditions, including epilepsy, myotonia (uncontrolled muscle contraction) and cystic fibrosis, involve malfunctioning ion channels. Better understanding of ion channels will allow design of new drugs that target the channels' specific parts and functions, Dr. French says. Future medications could better manage conditions such as arrhythmia (abnormal heartbeat) and pain, and help protect tissue from heart attack or stroke.

Dr. French is a Heritage Scientist and Professor in the Department of Physiology and Biophysics at the University of Calgary. He received an MRC Distinguished Scientist award in 1996, and receives funding from the Canadian Institutes of Health Research and the Heart and Stroke Foundation.

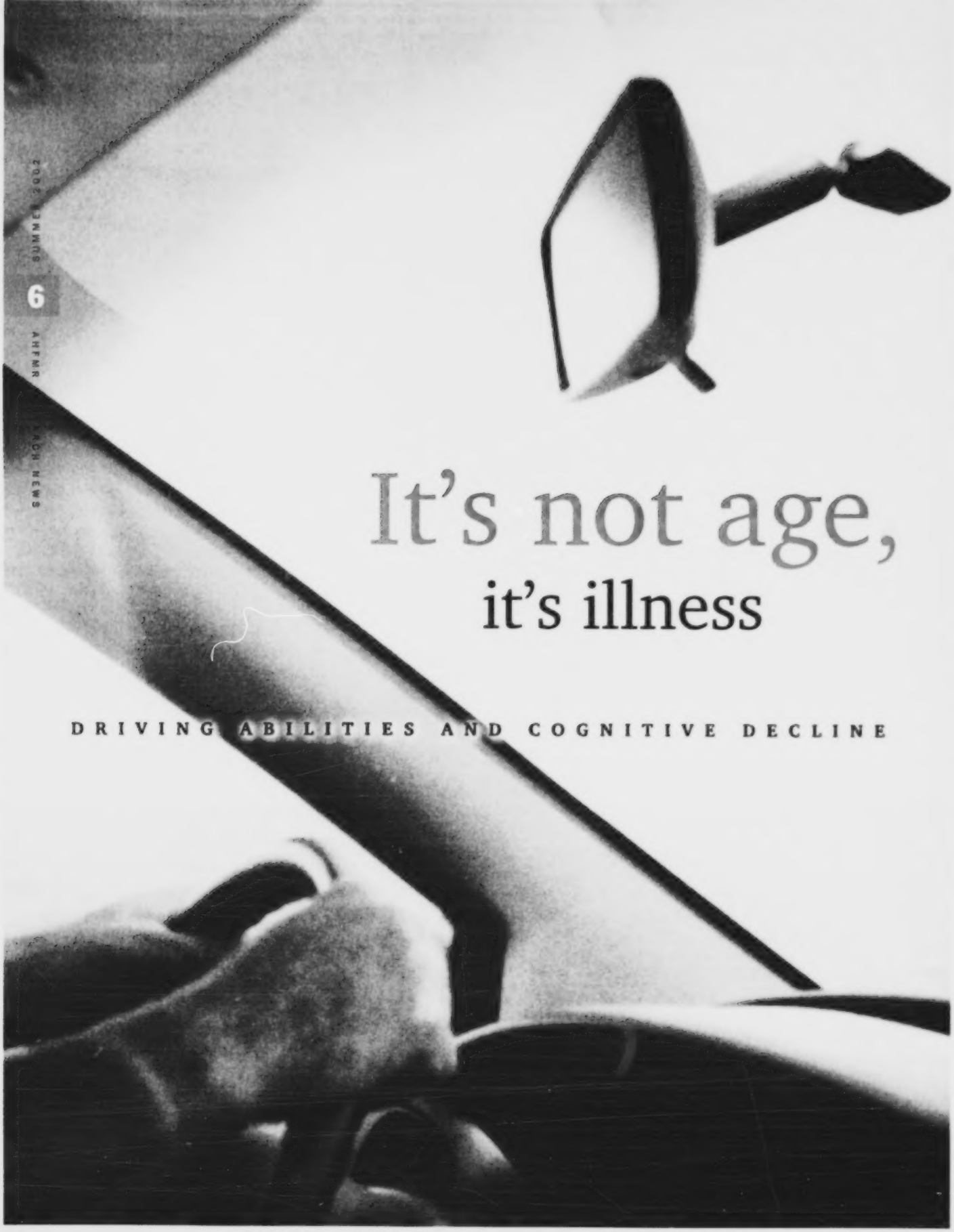
Recent publications

Hui K, Lipkind G, Fozzard HA, French RJ. Electrostatic and steric contributions to block of the skeletal muscle sodium channel by muconotoxin. *Journal of General Physiology* 2002; 119:45-54.

Light PE, Kanji HD, Manning Fox JE, French RJ. Distinct myoprotective roles of cardiac sarcolemmal and mitochondrial KATP channels during metabolic inhibition and recovery. *FASEB Journal* 2001; 15(14):2586-2594.

French RJ, Dudley SC, Jr. Pore-blocking toxins as probes of voltage-dependent channels. In: Conn PM, ed. Ion Channels. *Methods in Enzymology* (series), vol. 294. New York: Academic Press, 1998. pp. 575-605.

ABOVE: DR. ROBERT FRENCH



It's not age, it's illness

DRIVING ABILITIES AND COGNITIVE DECLINE

Maybe I should have done something earlier.

Dr. Allen Dobbs has an answer. A Professor Emeritus at the University of Alberta, Dr. Dobbs has developed a driver assessment for scientific and accurate decision-making about the driving of individuals with cognitive decline. With the assistance of AHFMR's Technology Commercialization (TC) Program, he has turned the research into a business—DriveABLE Assessment Centres Inc.—that offers objective assessments of driving competence.

Dr. Dobbs emphasizes that the issue is driving competence, not age. In the case of the above-mentioned 73-year-old man, the issue was frontal-lobe dementia and its effects on his thinking processes. "Talking about older drivers puts the focus on the wrong group," Dr. Dobbs explains. "The best of drivers—no matter what their age—can become unsafe when medical conditions alter their abilities. It's not just Alzheimer's or dementia. Conditions such as cardiovascular disease, stroke, diabetes, or renal disease can also cause cognitive impairments. There's no doubt that as you get older, you are more likely to have these conditions. But the issue isn't age; it's illness."

So how do you know when a person is too ill to drive? This question was first posed to Dr. Dobbs in 1991 by the geriatric specialists he worked closely with at the Edmonton General Hospital. At the time, Dr. Dobbs was a psychology professor at the University of Alberta. The focus of his research was the cognitive decline associated with dementia.

"The physicians at the Edmonton General Hospital's memory clinic had patients who were driving," recounts Dr. Dobbs. "These people wanted to know whether they should still be behind the wheel. It seemed like a straightforward question, but when I began looking for the answer, I realized that little research had been done in this area. It appeared to be an interesting problem. I thought we should pursue it."

The timing was right. Alberta's Health Services Research and Innovation Fund had just been established and, along with the Canadian Aging Research Network (one of the Networks of Centres of Excellence) and the Alberta Mental Health Research Fund, awarded Dobbs initial funding for the project.

The research team—headed by Dr. Dobbs, with colleagues in psychology and medicine—took an innovative approach to driving assessment. The conventional view was that driving assessment was a qualitative undertaking that relied on professional opinion; the researchers' view was that driving evaluation should be scientifically based.

In 1992, they began a study of 500 drivers from three groups: cognitively impaired drivers, healthy older drivers, and healthy younger drivers. Comparisons of the driving errors of the healthy groups against those of the cognitively impaired group allowed the team to isolate and define the type and severity of errors that cognitively impaired

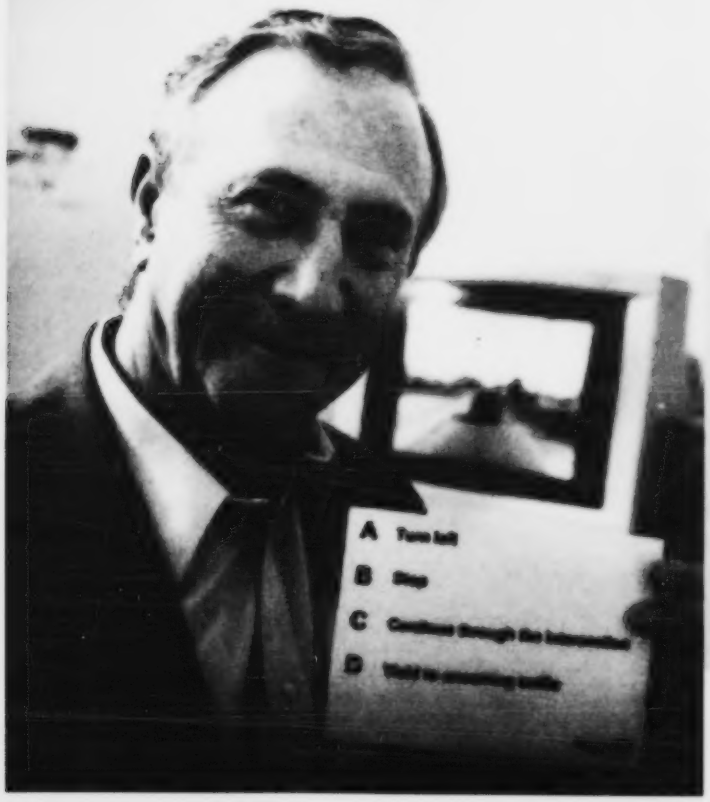
Page 8 ▶

"The best of drivers—no matter what their age—can become unsafe when medical conditions alter their abilities."

drivers make. They then developed a scoring system that focuses on these errors. To protect the competent driver, the scoring system excludes errors typically made by experienced, healthy drivers.

Their next challenge was to devise a road course to ensure that drivers are adequately tested. The team developed rules for laying out this course, so that it can be reproduced in any city. Another key accomplishment was development of the criteria for passing or failing the test. Scientific data were used to set the unsafe driver criteria as being "out of the range of normal." After this phase, another 400 people were tested to validate the results. The team knew it had developed a good assessment method.

"Our job was done—or so we thought," says Dr. Dobbs. "But people said, no, you can't stop here because this research needs to be put into practice.



I saw myself as a researcher, not as someone who commercializes research. Eventually, though, I realized that if I didn't do it, no one else would."

In 1998, Dr. Dobbs retired from the University of Alberta to start DriveABLE Assessment Centres Inc. Funding from AHFMR's Technology Commercialization Program and the National Research Council, and assistance from the University of Alberta Industry Liaison Office, helped support and develop the company in its early stages.

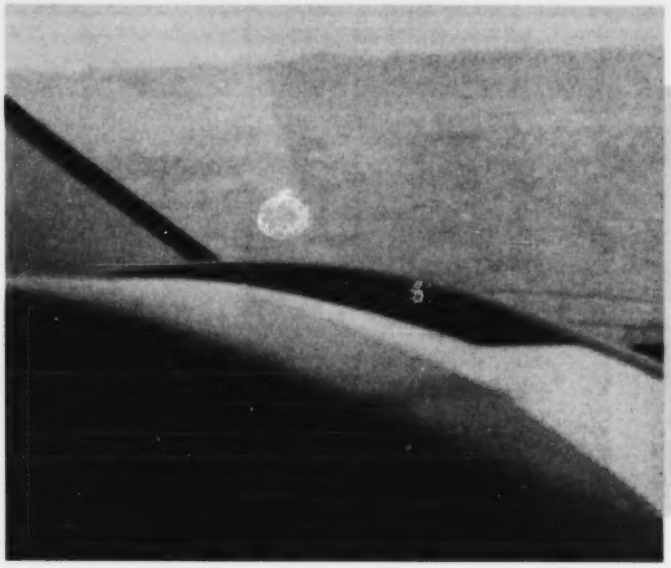
"I made the move to business with apprehension," says Dr. Dobbs. "I really liked being a university professor; I enjoyed my job. But this company needed a champion. And we had developed something that could make a difference. I needed to see it through."

DriveABLE has a home office in Edmonton and 10 assessment centres across Canada. There are also four DriveABLE research centres in Florida, and research projects are underway in Australia. Centres

Warning signs of cognitively impaired driving

- Lack of awareness of driving errors
- Tendency to get lost or confused while driving
- Seeming lack of awareness of other vehicles
- Tendency to miss traffic signs
- Inability to keep up with the speed of traffic
- Close calls, especially if seemingly unnoticed
- Frequent honking from other drivers

LEFT: DR. ALLEN DOBBS



Medical conditions are associated with high crash rates.

Compared to healthy drivers:

- Drivers with a neurological condition are more than 5 times more likely to be involved in an at-fault crash.
- Drivers with cognitive impairments are more than 7 times more likely to be involved in an at-fault crash.

Source: US Department of Transportation National Highway Traffic Safety Administration, Diller et al., 1998.

are licensed to use the DriveABLE system, and receive equipment, software, training, and road course set-up from the company. Business comes from physicians, licensing bureaus, insurance companies, and some self-referrals.

The DriveABLE assessment has two components: a computer-based competence screening and a road test. The screening identifies the most dangerous drivers without the need for a road test. The road test is administered by specialized driving evaluators trained by DriveABLE. Performance is scored based on the standardized procedures developed and validated through the extensive research done by Dr. Dobbs and his team.

Data from all tests are sent via the Internet to the DriveABLE home office for scoring. Periodic monitoring of error types at each location provides information on how well the road testing is being conducted and is key to maintaining quality assurance.

Dr. Dobbs notes that DriveABLE has received a tremendous positive response from physicians. "When a doctor recommends a patient's licence be revoked, the action has implications for the physician-patient relationship," he explains. "Using DriveABLE, doctors don't have to say, 'I think you should give up driving.' Instead, they can rely on the results of an objective assessment grounded in science."

Of course, taking away a licence solves one problem but often creates a host of others, Dr. Dobbs acknowledges. "There's probably no greater marker of independence in North America than having a driver's licence. Independence and self-esteem are all tied up with the ability to drive.

"We're starting to get more involved with these aspects in our centres. People who have their licence taken away need help. We'd like to move into providing information and materials for counselling these individuals and their families. If they can't drive, they probably need assistance with other aspects of their lives." Dr. Dobbs' wife, gerontologist Dr. Bonnie Dobbs, is directing a study funded by the Alzheimer Society of Canada, looking at support groups for ex-drivers and their families.

"The main point with DriveABLE is that we're providing objective evidence to get dangerous drivers off the road," says Dr. Dobbs. "It's like taking away a person's keys when they've had too much to drink. DriveABLE is an injury-prevention program. Society now accepts that driving while drunk is not acceptable. Yet we still accept that driving while illness-impaired is okay. This attitude has to change.

"When mental abilities are affected, driving competence is always questionable. The decision is too important to be left to opinion. The decision must be based on facts."

In addition to funding from AHFMR's TC program, Dr. Allen Dobbs also received funding from the Canadian Aging Research Network, Alberta's Health Services Research and Innovation Fund, and the Alberta Mental Health Research Fund (the latter two are now known as the Health Research Fund which is administered by AHFMR on behalf of Alberta Health and Wellness).

Selected publication

Dobbs AR, Heller RB, Schopflocher D. A comparative approach to identify unsafe older drivers. *Accident Analysis and Prevention* 1998 May;30(3):363-70.

On the cutting edge of JOINT RESEARCH

"When I came around a turn, I hit an icy patch on the hill and lost control. My skis crossed, then I fell. I could hear a tearing sound... the pain was excruciating."

That's how 47-year-old Linda Smith* started off the new year. Her skiing accident resulted in complete and partial tears of ligaments in both her knees.

"I came home with braces on my legs, but it wasn't until I had an MRI and consulted with doctors and physiotherapists that I began to appreciate the severity of what had happened to me. I now realize that my knees will never be the same again."

Six months after her accident, Linda is making an amazing recovery. She's back at work and participating in intensive physiotherapy and exercise programs.

"I'm walking well, and I'm much stronger than I was. However, I think about my knees all the time...before my accident I would have laughed at the idea of thinking about my knees all the time. I worry about pivoting and having my knees give out, or about my dogs bumping me in the knees. I'm very cautious on uneven ground because I'm terrified of tripping.

"And then there's ten or fifteen years down the road. Are my knees going to hurt all the time? Will I get osteoarthritis? When I'm a grandmother, will I be able to kneel down and play with my grandchildren?"

This story is all too familiar to orthopaedic surgeon and Heritage Scientist Dr. Cy Frank. "Joint injury is a tremendous shock to a person's life. Many people think of joint injury as an illness–something that they will recover from after a defined period of time. But joint injury is often not like this. Healing takes a long time, and sometimes does not happen at all or happens incompletely. There are often long-term effects, and joint injuries frequently alter what patients can do for the rest of their lives.

"However, the outlook for patients with joint injuries is much better now than it was even five years ago. We now understand a lot more than we did about joints and healing. We can prescribe things scien-

Page 12 ▸

"We're moving to an age of science in the treatment of bones and joints."

** The name has been changed.*

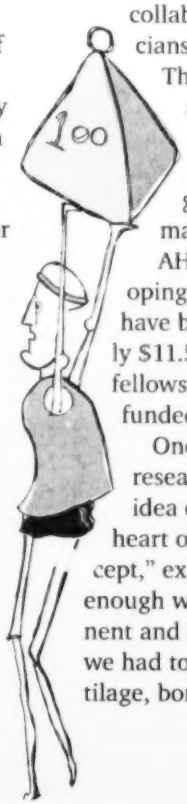
tifically that we couldn't have years ago—and we're beginning to understand what's going on in the cells in these tissues.

"Still, what we offer patients today are only patches. We're not yet delivering solutions. Our challenge as researchers is to do better. We're moving to an age of science in the treatment of bones and joints."

Dr. Frank, who is a professor at the University of Calgary, is known for his pioneering research into ligament healing and repair. A renowned knee surgeon, he collaborates with a team of researchers at the university's McCaig Centre for Joint Injury and Arthritis Research—a centre known for its revolutionary research in gene therapy, ligament transplantation, and arthritis treatments.

The McCaig Centre group is on the leading edge of joint research. The multidisciplinary team of 26 engineers and scientists is drawn from the University of Calgary's faculties of Medicine, Kinesiology, and Engineering. Research projects cover three major areas: biomechanics (the analysis of motion, muscle function, loads at joints, joint function), biomaterials (the architecture of tissues, tissue function, orthopaedic implants) and systems physiology (the interaction of biochemistry and molecular biology, morphology, physiology and mechanics in disease progression and healing processes). Total annual research funding for the group is in excess of $5 million.

"We've created an excellent environment for collaboration," says Dr. Frank. "We have clinicians who are receptive to new knowledge. There are also clinician-scientists who work at the interface of the laboratory and the bedside. And we have researchers who are creators of new knowledge. Our goal is to see that the research we do makes a difference in people's lives."



AHFMR has played a critical role in developing this group. Since 1991, ten scientists have been funded by AHFMR for approximately $11.5 million. McCaig Centre students, fellows, and summer students have also been funded by AHFMR for a total of $4.5 million.

One of the key concepts underlying the research done at the McCaig Centre is the idea of the joint as an organ, similar to a heart or a lung. "This is a relatively new concept," explains Dr. Frank. "Research has gone far enough with reductionism—taking each component and looking at it in detail. We realized that we had to start looking at connections among cartilage, bone, ligaments, synovium, tendons, and

muscles. If one part of a joint, such as a ligament, is damaged, other parts of the joint are affected. You can't simply study the individual parts in isolation.

"This is our strength. Individually we have depth; collectively we have breadth. And we work together to synthesize the findings from individual research programs into a coherent picture of what is going on in joints. Why do some components heal well and others only poorly? What can surgeons do to optimize the recovery of patients with ligament problems? Why does osteoarthritis develop in an injured joint? These are some of the important questions we are attempting to answer."

Understanding Healing

We need our knees. Unfortunately, many of the things we use them for–like jumping, running, and climbing–can damage certain parts of the knee. Cartilage and the menisci (moon-shaped cushion pads in the knee) can be torn or worn away. Prolonged athletic activity can irritate or roughen the kneecap. Ligaments are fibrous bands that connect the bones of the knee and provide stability to the joint. A torn ligament, especially the anterior cruciate ligament, can be exceedingly disabling.

Ligaments heal by a process that resembles scar formation. But a healed ligament is a mechanically inferior structure and often fails to provide adequate joint stability. This can lead to re-injury, a chronically lax joint, or progression to osteoarthritis.

"There's an incredible architecture in the soft tissues of our joints," says Dr. Nigel Shrive, current chair of the research group. One of his main research areas is the mechanical and structural behaviour of normal, healing, and transplanted ligaments. "Tissues such as ligaments play key roles in joint motion and joint stability. The cells in the tissues react to a load and produce proteins that

Page 14 ▸

Learning to preserve cartilage

The leg bone's connected to the thigh bone, so the song goes. But if it weren't for the slippery articular cartilage at the ends of bones, a connection is all there would be—a connection, but no movement. Cartilage is key to keeping the moving parts in your knee moving.

When osteoarthritis damages the cells that make up the articular cartilage, the cells cannot repair themselves. This sets off a chain reaction of joint destruction. Scientists know that cartilage degradation often starts at a focal point. With improved diagnosis through imaging techniques such as MRI, it may be possible to identify those at risk of losing their cartilage. In turn, this opens up the possibility of treating the problem before it spreads and all the cartilage is destroyed. But how do you treat a tissue that can't heal itself?

One answer is to replace it. Right now, this can be done with a cartilage transplant. However, the procedure is only a temporary measure because the transplanted cartilage cells are dead. Cartilage must be stored, and the cells are killed during freezing. The thawed but acellular cartilage retains some function, but it only lasts for about five years.

But maybe freezing doesn't have to kill cells, says Heritage Scholar Dr. Ken Muldrew. A McCaig Centre member, Dr. Muldrew is a specialist in cryopreservation (the maintaining of tissues or organs through storage at very

low temperatures), particularly the development of techniques to freeze cartilage. "We're doing basic research in cryobiology, trying to discover the underlying mechanisms of freezing injury. We can freeze and thaw isolated cells without injury, but freezing tissue is much more complex."

Dr. Muldrew notes that, contrary to popular belief, frozen cells do not die because "ice blows them apart"—in fact, the stresses that kill frozen cells are mainly chemical.

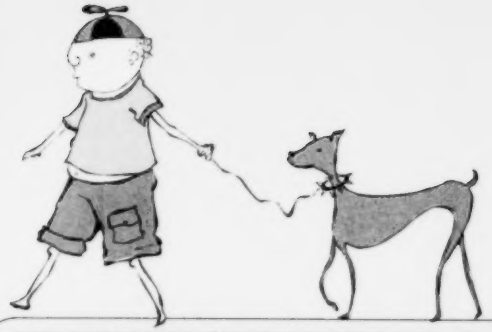
"Understanding the mechanisms of cryoinjury is fundamental research that will have important applications," says Dr. Muldrew. "It should enable us to design freezing protocols in which injury to cartilage cells can be avoided or minimized. This would be a significant step toward preventing osteoarthritis by transplanting cartilage."

Dr. Ken Muldrew is a Heritage Scholar and Assistant Professor in the departments of Cell Biology & Anatomy and Surgery at the University of Calgary. His research is also supported by the Canadian Institutes of Health Research (CIHR).

Selected publication

Muldrew K, Novak K, Yang H, Zernicke R, Schachar NS, McGann LE. Cryobiology of articular cartilage: ice morphology and recovery of chondrocytes. *Cryobiology* 2000 Mar;40(2):102-9.

ABOVE: DR. KEN MULDREW



"I can now see a day when surgeons will be restoring joints and returning patients to the level of function they had prior to their accident."

assemble themselves to carry these loads. The level of complexity is amazing, but how it all works is still very much a black box to us."

Dr. Shrive is working with Dr. Frank and another McCaig Centre colleague, Dr. David Hart, a Professor in the Department of Microbiology and Infectious Diseases at the University of Calgary, to understand cell-tissue load interaction. They are particularly interested in how loading affects the cellular activity that drives healing, the range of loads to which a ligament is subject during healing, and how other tissues in the joint may compensate for or begin to fail under the changing stability of the joint.

The team is working on developing ways of improving the healing of damaged or reconstructed ligaments. "If we can get a handle on how gross behaviour of the tissue can be improved by different treatment regimens, perhaps we can do things therapeutically to enhance healing for patients," says Dr. Shrive.

In another area of research, Dr. Shrive is working with Associate Professor Dr. Janet Ronsky from the Department of Mechanical and Manufacturing Engineering, to understand what happens in the joint when ligaments are injured. They are developing techniques to determine the *in vivo* loading on tissues. Analytical models of joints are used to study contact between joint cartilage layers and investigate the stress distributions in joint structures. "We're interested in understanding how ligament damage alters loads in other joint tissues," explains Dr. Shrive. "What is it that causes these injured joints to often develop arthritis?

"These are multifaceted, tricky problems. You can't just focus in on one thing, thinking that it will be the magic bullet to cure diseases. The basic approach at the McCaig Centre has been to bring together experts in different fields so we can understand how the different areas interact. We've managed to achieve a level of communication and interaction that to others appears quite extraordinary."

Working together

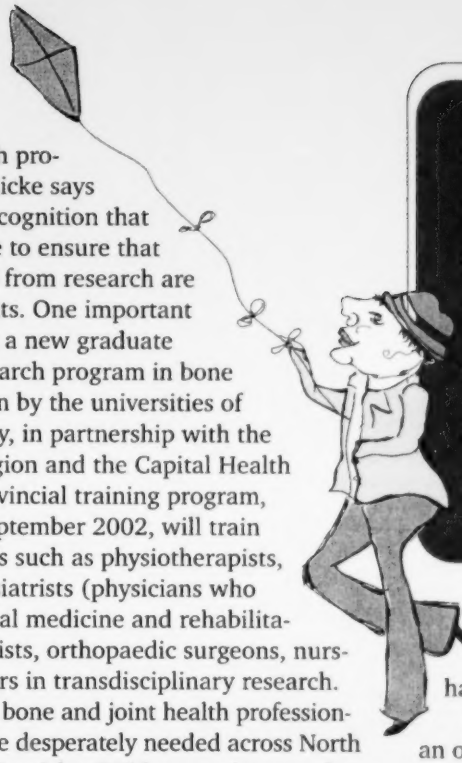
The collaborative, multidisciplinary approach of the McCaig Centre caught Dr. Ron Zernicke's attention 10 years ago and was an important factor in his decision to move from UCLA to the University of Calgary. Today, Dr. Zernicke is Dean of the Faculty of Kinesiology and has cross-appointments in the faculties of Medicine and Engineering. "My research collaborations—and my colleagues at the McCaig Centre have similar wide-ranging collaborations—demonstrate that we have a research culture that encourages transdisciplinary work. There are no boundaries. It's a very stimulating environment."

One of Dr. Zernicke's main research areas is the functional adaptation of bone, especially in osteoarthritis. "It's a different approach because most research to date has focused on how a mechanical injury to a ligament puts the cartilage at risk," he explains. "I'm looking at how the injury affects the bone. For example, we see dramatic changes in blood flow and the structure of bone, especially porosity. We believe these changes in the bone put the cartilage at risk."

There may be ways to prevent some of these changes. Dr. Zernicke is collaborating with Dr. Hasan Uludag, from the University of Alberta's Faculty of Engineering, and Dr. Robert Bray in the Department of Surgery at the University of Calgary, in a project investigating the use of certain drugs to protect the bone after injury.

"For more than 20 years, the emphasis has been on the cartilage," says Dr. Zernicke. "Now we're looking at the joint as an organ. We understand that if one element is injured or changed, the whole system is going to be affected. This understanding has tremendous implications for therapy."

Keeping up with the leading-edge research and translating it into useful therapies for patients is a



One of the key concepts underlying the research done at the McCaig Centre is the idea of the joint as an organ, similar to a heart or a lung.

challenge for health professionals. Dr. Zernicke says there is growing recognition that more must be done to ensure that the insights gained from research are used to help patients. One important Alberta initiative is a new graduate education and research program in bone and joint health run by the universities of Alberta and Calgary, in partnership with the Calgary Health Region and the Capital Health Authority. This provincial training program, which begins in September 2002, will train health professionals such as physiotherapists, kinesiologists, physiatrists (physicians who specialize in physical medicine and rehabilitation), rheumatologists, orthopaedic surgeons, nurses, and chiropractors in transdisciplinary research.

"Highly qualified bone and joint health professionals and scientists are desperately needed across North America," says Dr. Zernicke. "With our aging population, this need will grow rapidly in the next 20 years. One of every ten Canadians currently suffers from osteoarthritis, and within two decades it is estimated that 20% of Canadians will have the disease."

A better outlook

While Linda Smith's ligament injuries are serious and debilitating, the outlook for patients like her is improving. "Twenty years ago, knowledge about joint injury was minimal," says Heritage Senior Scholar Dr. Robert Bray, an orthopaedic surgeon and professor at the University of Calgary.

"Many ligament injuries went undiagnosed and a lot of the surgery was not very helpful. We haven't perfected things yet, but we are certainly moving in that direction.

"People sometimes grumble about the amount of attention given to elite athletes who are injured. But they are the ones who pushed for better treatment of joint injuries, and this led to research that has resulted in improved therapies."

A case in point is Dr. Bray's career. Trained as an orthopaedic surgeon, he became interested in the physiology of ligaments, especially why they do not heal well. "The standard answer is that blood flow isn't adequate in these tissues," says Dr. Bray. "I wanted to learn more about this."

In 1991, Dr. Bray received an establishment grant from AHFMR and began a research program as a Heritage Clinical Investigator at the University of Calgary. "Cardiac researcher and Heritage Scientist Dr. John Tyberg took me under his wing and taught me all about blood flow," he explains.

Dr. Bray has continued this line of research, which has recently resulted in the development of a non-invasive tool for studying blood flow and its role in tissue repair. It was designed by his Ph.D. student Kevin Forrester, who was co-supervised by University of Alberta engineering professor Dr. John Tulip. Pending approval, the instrument—called a laser speckle perfusion imager—will be used to take measurements of blood flow during certain orthopaedic operations at Calgary's Peter Lougheed Centre hospital.

"This is largely a trial of the instrument's application," notes Dr. Bray. "We'll collect data and be able to evaluate its usefulness. Beyond this first step, I'm excited by the possibilities. We say the blood supply is a determinant of the health of tissue, and yet we don't measure it. We need good, accurate measurements that we can link to patient problems and outcomes of treatments such as arthroscopic surgery.

Page 17 ▸

THE mechanisms of arthritis pain

In a painful arthritic joint, nerve impulses travel at an increased rate, and the brain interprets this information as pain.

Pain is the number one complaint of arthritis sufferers, and truly effective pain control eludes many patients. "To date, surprisingly little research has been done on arthritis pain," says Heritage Scholar Dr. Jason McDougall, a member of the McCaig Centre team. "This is an absolute travesty when you consider that millions of patients are suffering daily from the debilitating effects of arthritis pain. We need to understand the mechanisms of arthritis pain to allow us to develop more effective drugs."

The focus of Dr. McDougall's research is the neural control of joint inflammation and pain. His particular interest is in a group of neurotransmitters called neuropeptides. They play an important role in controlling blood flow, the formation of new blood vessels, and the permeability ("leakiness") of blood vessels. Neuropeptides also have an effect on nerve sensitivity in our joints. In a painful arthritic joint, nerve impulses travel at an increased rate, and the brain interprets this information as pain.

"Neuropeptides do have beneficial physiological effects," notes Dr. McDougall, "but in rheumatoid arthritis and osteoarthritis,

Currently pain medication is given systematically which can cause serious side effects.

the processes that control neuropeptides are unregulated. My lab is involved in testing the effects of various drugs on regulating neuropeptides.

"Currently, pain medication is given systemically, which can cause serious side effects. Through our research, we may be able to find a way to treat the precise source of the pain and therefore avoid the side effects. And because inflammation and pain are closely linked, we may uncover novel therapies that will not only control the debilitating effects of arthritic pain but will also prevent the progression of inflammatory joint disease."

Dr. Jason McDougall is a Heritage Scholar and an Assistant Professor in the Department of Physiology and Biophysics at the University of Calgary. His research is also supported by the Arthritis Society, the Canadian Institutes of Health Research (CIHR), and the Western Orthopaedic Research Fund.

Recent publication

McDougall JJ, Hanesch U, Pawlak M, Schmidt RF. Participation of NK1 receptors in nociceptin-induced modulation of rat knee joint mechanosensitivity. *Experimental Brain Research* 2001 Mar;137(2):249-53.

ABOVE: DR. JASON MCDOUGALL

ARTWORK: DARCI MALLON. *EIDETIC*. 1993. INK, MYLAR, FLUORESCENT LIGHTS. 274.3 X 426.7 X 50.2 CM. COLLECTION OF THE ALBERTA FOUNDATION FOR THE ARTS

JOINT RESEARCH

Continued from Page 15 ▸

"I started doing this research 13 years ago, and I finally feel I'm getting somewhere. Sometimes it seems frustrating, but nature is subtle and it takes a long time to figure things out. As a surgeon, I know that I am still reconstructing joints, not restoring them. Many of us are driven to do better. I can now see a day when surgeons will be restoring joints and returning patients to the level of function they had prior to their accident."

Dr. Cy Frank is a Heritage Scientist and Professor in the Department of Surgery at the University of Calgary. He is the McCaig Professor in Joint Injury and Arthritis Research and was recently named Scientific Director of the Institute for Musculoskeletal Health and Arthritis, one of the Canadian Institutes of Health Research (CIHR).

Dr. Nigel Shrive is a Professor in the Department of Civil Engineering at the University of Calgary and holds a Killam Memorial Research Chair. Research done by Drs. Frank and Shrive is also supported by the Arthritis Society of Canada, the Canadian Institutes of Health Research (CIHR), and the Canadian Arthritis Network.

Dr. Ron Zernicke is Dean of the Faculty of Kinesiology with cross-appointments in the faculties of Medicine and Engineering and is the John and Chris Wood Professor in Joint Injury Research. He is a past recipient of AHFMR funding and his research is currently supported by the Arthritis Society of Canada, the Canadian Orthopaedic Foundation, the Canadian Institutes of Health Research (CIHR), the Canada Foundation for Innovation, the Alberta Children's Hospital Foundation, NSERC (Natural Sciences and Engineering Research Council of Canada), and the Workers' Compensation Board.

Dr. Robert Bray is a Heritage Senior Scholar and Professor in the Department of Surgery at the University of Calgary. His research is also supported by the Canadian Institutes of Health Research (CIHR), the Arthritis Society of Canada, the Whitaker Foundation, the Department of National Defence, and the Olympic Oval Foundation.

Selected publications

Lo IK, Ou Y, Rattner JP, Hart DA, Marchuk LL, Frank CB, Rattner JB. The cellular networks of normal ovine medial collateral and anterior cruciate ligaments are not accurately recapitulated in scar tissue. *Journal of Anatomy* 2002 Mar;200(Pt 3):283-96.

Thornton GM, Frank CB, Shrive NG. Ligament creep behaviour can be predicted from stress relaxation by incorporating fiber recruitment. *Journal of Rheology* 2001 Mar/Apr;45(2), 493-507.

Majima T, Marchuk LL, Sciore P, Shrive NG, Frank CB, Hart DA. Compressive compared with tensile loading of medial collateral ligament scar *in vitro* uniquely influences mRNA levels for aggrecan, collagen type II, and collagenase. *Journal of Orthopaedic Research* 2000 Jul;18(4):524-31.

Boyd SK, Muller R, Zernicke RF. Mechanical and architectural bone adaptation in early stage experimental osteoarthritis. *Journal of Bone and Mineral Research* 2002 Apr;17(4):687-94.

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JOINT RESEARCH

Continued from Page 15 ▸

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Restoring movement

While some might debate the pros and cons of commercializing research, you won't hear those arguments in Heritage Scientist Dr. Arthur Prochazka's lab. His neuroscience research is clearly focused on developing devices to help people who have lost function because of a spinal cord injury.

"There's no doubt that pure research can lead to astonishing practical applications. An important part of our job is to promote this transition if and when the opportunity arises," he explains. "A spinal cord injury is a devastating blow to a person's life. The applied part of my research is aimed at helping patients regain some function, some independence. We owe it to patients to succeed."

Dr. Prochazka specializes in developing devices that use functional electrical stimulation (FES) to produce contractions in muscles which have been paralyzed due to central nervous system lesions. The electrical stimulation is applied either through skin-surface or implanted electrodes. Applications go beyond spinal cord and head injury to stroke, cerebral palsy, and multiple sclerosis.

One of the devices developed in Dr. Prochazka's lab is the Bionic Glove, which allows a motion-impaired individual to grip an object. When worn by quadriplegics who still have some movement in their wrist, the Glove senses wrist movement and electrically stimulates different muscles in the forearm, causing the paralyzed thumb and fingers to form a pinch grip.

Another device is the Impact Cuff for individuals who are paralyzed on one side of the body, usually due to a stroke. These people often suffer from spasticity, which can make it difficult to perform many common tasks. The Cuff stimulates the nerves to direct the appropriate muscles to either open or close the hand. Arm and hand function could be significantly improved over conventional therapy by combining use of the Cuff with a regular, supervised re-training program. A clinical trial of this device is underway in Edmonton at the Glenrose Hospital.

While restoring movement is an obvious need for spinal-cord-injured patients, surveys show that being able to stand or walk are not the highest priorities for these patients. After the two top-rated needs of inde-

DR. ARTHUR PROCHAZKA AND MEMBERS OF HIS LAB. (L TO R): DOMINIC CARNEY, VALERIYA GRITSENKO, ALLEN DENINGTON, JAN KOWALCZGWSKI, MICHEL GAUTHIER, SERGIY YAKOVENKO (SEATED) AND DR. ARTHUR PROCHAZKA

ARTWORK

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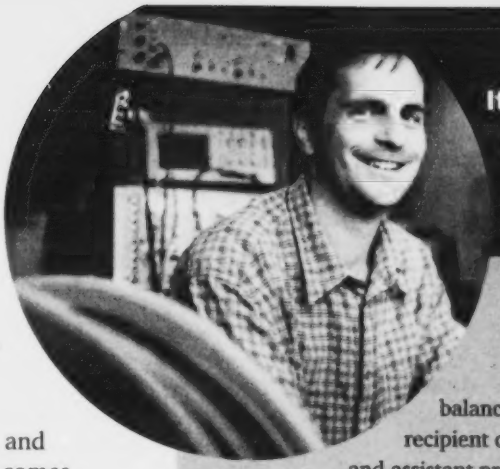

DR. JOHN MISIASZEK

finding one's balance

It's one thing to walk on four legs; it's quite another when you have only two.

"Human locomotion is complex because of our bipedal posture. Basically, humans are a large mass balanced on spindly sticks," says Dr. John Misiaszek, recipient of an AHFMR Independent Establishment Grant and assistant professor at the University of Alberta. "Maintaining balance is absolutely necessary for effective movement."

It's also one of the limiting factors in rehabilitation. "We tend to focus on getting people walking again, and if we're successful, it appears we've solved their problems—but not if they don't have proper balance," adds Dr. Misiaszek. "If you have to use a walker, you're faced with the same kinds of limitations that you face in a wheelchair. Things like stairs and the width of doorways are just as much of an issue." Another important area is balance control in elderly people, for whom falls are a serious health concern.

"How can we approach these problems and help people when we don't fully understand how balance is controlled to begin with?" says Dr. Misiaszek. "What we know about balance control is very limited. It's the focus of my research."

Like most researchers in this area, Dr. Misiaszek has done a lot of work on understanding balance and locomotion in animals. He has recently expanded his research into humans. "The idea is that these two lines of research will parallel each other. If I find questions that I can't ask in humans, I can use experiments with animals. And there are results from animal experiments that I will want to verify in humans."

Dr. Misiaszek's research got a boost this year when he won an AHFMR Independent Establishment Grant. The funding will allow him to purchase a 3-D motion analysis system—the Peak Motus system, manufactured by Peak Performance Technologies Inc.—for studying locomotion and balance in humans. "This equipment will help us get a better appreciation of how people maintain balance when they're walking," he says. "We'll be able to understand more about how locomotion control strategies differ from balance control strategies. This is an exciting area because it's largely untapped. We'll be asking questions that no one knows the answers to."

Dr. Misiaszek's research is supported by an Independent Establishment Grant from AHFMR, as well as an operating grant from NSERC (the Natural Sciences and Engineering Research Council). He also received fellowship support from AHFMR and NSERC during his post-doctoral training. Dr. Misiaszek is an Assistant Professor in the Department of Occupational Therapy at the University of Alberta

Recent Publication

Misiaszek JE, Stephens MJ, Yang JF, Pearson KG. Early corrective reactions of the leg to perturbations at the torso during walking in humans. *Experimental Brain Research* 2000 Apr;131(4):511-523.

pendent respiration and freedom from pain, comes bladder and bowel function. Dr. Prochazka is working in this area with Heritage Scholar Dr. Vivian Mushahwar, an Assistant Professor in the Department of Biomedical Engineering at the University of Alberta. They use a technique known as intraspinal microstimulation (ISMS) to help people regain bladder control. ISMS involves implanting fine, hair-like wires inside the spinal cord and passing electrical pulses through these wires to stimulate nerves in the bladder.

"Bladder control is rather complex—certain muscles have to contract, while others must relax," explains Dr. Prochazka. "Our aim is to go to the particular part of the spinal cord that inhibits the sphincter muscle and controls the bladder. This is a unique approach because we're looking at separate controls. We hope it will result in more natural function."

Dr. Prochazka is a Heritage Scientist and Professor in the Faculty of Medicine's Department of Physiology at the University of Alberta. His work with Dr. Mushahwar is supported by a contract from the US National Institutes of Health.

Recent publication

Prochazka A, Mushahwar VK, McCreery DB. Neural prostheses. *Journal of Physiology* 2001 May 15;533(1):99-109.

It's one thing to walk on four legs; it's quite another when you have only two.

Finding one's

"Human locomotion is complex because of our bipedal posture. Basically, humans are a large mass balanced on spindly sticks," says Dr. John Misiaszek, recipient of an AHFMR Independent Establishment Grant and assistant professor at the University of Alberta. "Maintaining balance is absolutely necessary for effective movement."

It's also one of the limiting factors in rehabilitation. "We tend to focus on getting people walking again, and if we're successful, it appears we've solved their problems–but not if they don't have proper balance," adds Dr. Misiaszek. "If you have to use a walker, you're faced with the same kinds of limitations that you face in a wheelchair. Things like stairs and the width of doorways are just as much of an issue." Another important area is balance control in elderly people, for whom falls are a serious health concern.

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Home rehab

The sudden start, stop, and twist movements in certain sports and recreational activities can sometimes deliver a knock-out blow to our knees. A case in point: After serious injury to a particular ligament inside the knee joint—the anterior cruciate ligament (ACL)—most people take six months to a year to recover, according to John Grant, a Heritage-supported Ph.D. student in the University of Calgary's Faculty of Kinesiology.

John's research includes a large study on an innovative way to rehabilitate active people who have had surgery following a "third-degree" ACL injury, in which the ACL is torn apart. "It's about finding clinically effective and cost-effective methods of successfully rehabilitating people," he says.

The knee can become unstable if one or more of the ligaments and other soft tissues that stabilize it are damaged, John notes. Key to joint stability are two X-crossed (cruciate) ligaments deep inside the joint, which connect the thigh bone (femur) and the shin bone (tibia). The ligament that crosses in front is the anterior cruciate ligament.

John, who works with ACL-injured patients at the university's Sport Medicine Centre, says the injury typically occurs in sports like basketball, soccer, skiing, and football, where people are moving fast and must stop or pivot quickly. Orthopaedic surgeons are able to replace the destroyed ligament with a graft, using part of the patellar tendon from the front of the knee or a tendon from the hamstring muscles at the back of the knee. ACL patients traditionally require numerous visits to physiotherapy clinics, especially in the three months following surgery.

For his 21-month study, John recruited 145 patients who had been physically active prior to

Compared to the clinic group, more patients in the home group had acceptable outcomes for range of motion in the knee.

their ACL injury and who underwent surgery to regain their active lifestyle. Randomly divided into two groups, patients in the control group had 17 visits to physio clinics in the three months following surgery. Patients in the experimental group had only four in-clinic visits, during which they received instruction on a self-motivated, at-home rehab program designed by John. He then compared the two groups for health outcomes, including the knee's range of motion, the laxity ("looseness") in the joint, and the strength regained in the thigh muscles.

Compared to the clinic group, more patients in the home group had acceptable outcomes for range of motion in the knee—the major indicator of rehabilitation success three months following surgery. No statistical differences were evident between the two groups for the other outcome measures. "In general, the home group did as well as or better than the clinic group," John says.

His research suggests that ACL patients who receive quality education and are highly motivated "can rehabilitate successfully with less supervised care." That means healthcare providers could reallocate some of the limited public funding available for supervised physiotherapy to other patients. Total costs of rehabilitation for the home group were also less than for the clinic group, according to preliminary data being examined with Dr. Cam Donaldson, a Heritage Senior Scholar in the departments of Community Health Sciences and Economics.

John Grant's Ph.D. is funded by a Heritage Studentship. Contributors to his study include the Calgary Health Region, the Calgary Orthopaedic Research and Education Fund, the Olympic Oval Endowment Fund, and industry partners Aircast, Inc. and Fitter International Inc. Supervisors are Dr. Ron Zernicke, Dean of the Faculty of Kinesiology at the University of Calgary, and Dr. Nick Mohtadi, Associate Clinical Professor in the Division of Orthopaedic Surgery.

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reader resources

Research views

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http://www.successful-aging.ca

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http://www.chps.ualberta.ca

Alberta Centre for Active Living
http://www.centre4activeliving.ca/

Unlocking the secrets of ion channels

University of Calgary Neuroscience Research Group
http://www.ucalgary.ca/~neuro/

It's not age, it's illness

DriveABLE Assessment Centres Inc.
http://www.driveable.com

On the cutting edge of joint research

McCaig Centre for Joint Injury and Arthritis Research
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Bone and Joint Decade web site (2000-2010)
http://www.bonejoint-decade.org

Restoring movement

Dr. Arthur Prochazka's home page
http://www.ualberta.ca/~aprochaz/hpage.html

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Heritage Youth Researcher Summer (HYRS) Program 2002

Breanne Everett, a 2001 Heritage Youth Researcher Summer (HYRS) Program participant, and one of her HYRS mentors, Dr. Linda Cook, won a $40,000 award from the Canadian Breast Cancer Research Initiative in May of this year. Their project? To continue the research Breanne was working on last summer during HYRS, involving the correlation between fingerprint patterns and breast cancer risk.

But the story goes back further than that. Breanne and her classmate at Springbank High School, Caitlin Hicks, had the idea to investigate the association between fingerprint patterns and breast cancer risk for a science fair project. Their project happened to be judged by Dr. Frans van der Horne (cancer researcher, University of Calgary) who referred the girls to Dr. Linda Cook, an AHFMR funded breast cancer researcher at the University of Calgary and the Alberta Cancer Board. Both researchers were so impressed that they urged the girls to apply for HYRS and Dr. Cook volunteered as a mentor.

Breanne and Caitlin's research success is precocious even by HYRS standards. Developed by the Alberta Heritage Foundation for Medical Research, HYRS is a hands-on summer research opportunity for Grade 11 students and is run at the University of Alberta, the University of Calgary, and the University of Lethbridge. HYRS participants are placed under the laboratory supervision and mentorship of university researchers, the majority of whom are AHFMR-funded. At the end of the six-week experience, students have to prepare a scientific poster about their project. When they return to Grade 12 in the fall, they give a presentation about their HYRS experience to their fellow students.

For this summer's HYRS Program, AHFMR received 170 applications, of which 45 were chosen by the three teacher adjudicators and two HYRS managers on AHFMR's selection committee. This year, nine HYRS alumni were successful in receiving AHFMR summer studentships, the applications for which require strong endorsements from senior university researchers. rn

For more information about the HYRS program or the Summer Studentship Program, please check the AHFMR Web site at www.ahfmr.ab.ca and click on "For Students".

ABOVE: DR. LINDA COOK AND BREANNE EVERETT

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